**May 27, 1999**

MEMORANDUM

SUBJECT: Examination of Recent Submissions from Amvac regarding Dichlorvos (DDVP) and Rationale for Not Including Them in the Exposure/Risk Assessment.

FROM: David Jaquith
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TO: Kimberly Lowe
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THRU: Sue Hummel, Senior Scientist
Chemical Exposure Branch 2
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Please find below the CEB2 review of ....

DP Barcodes: D255696, D255826 Pesticide Chemical Code: 084001

EPA Reg. No.: _____

Deferral to:

PHED: N/A

## 1.0 INTRODUCTION

HED has been requested to examine a number of publications and references submitted recently by Amvac regarding the insecticide DDVP. The registrant contends that valuable information was not included in the Agency's risk assessment for this compound. Many of the references in the current submission address indoor pest strip uses. Some of these were examined before and rejected for technical/suitability reasons. Others are either new to HED or expand on studies that were used for the

preliminary risk assessment. A brief summary of these studies and the rationale for their exclusion from the risk assessment is included in Section 3 of this document.

## 2.0 CONCLUSIONS

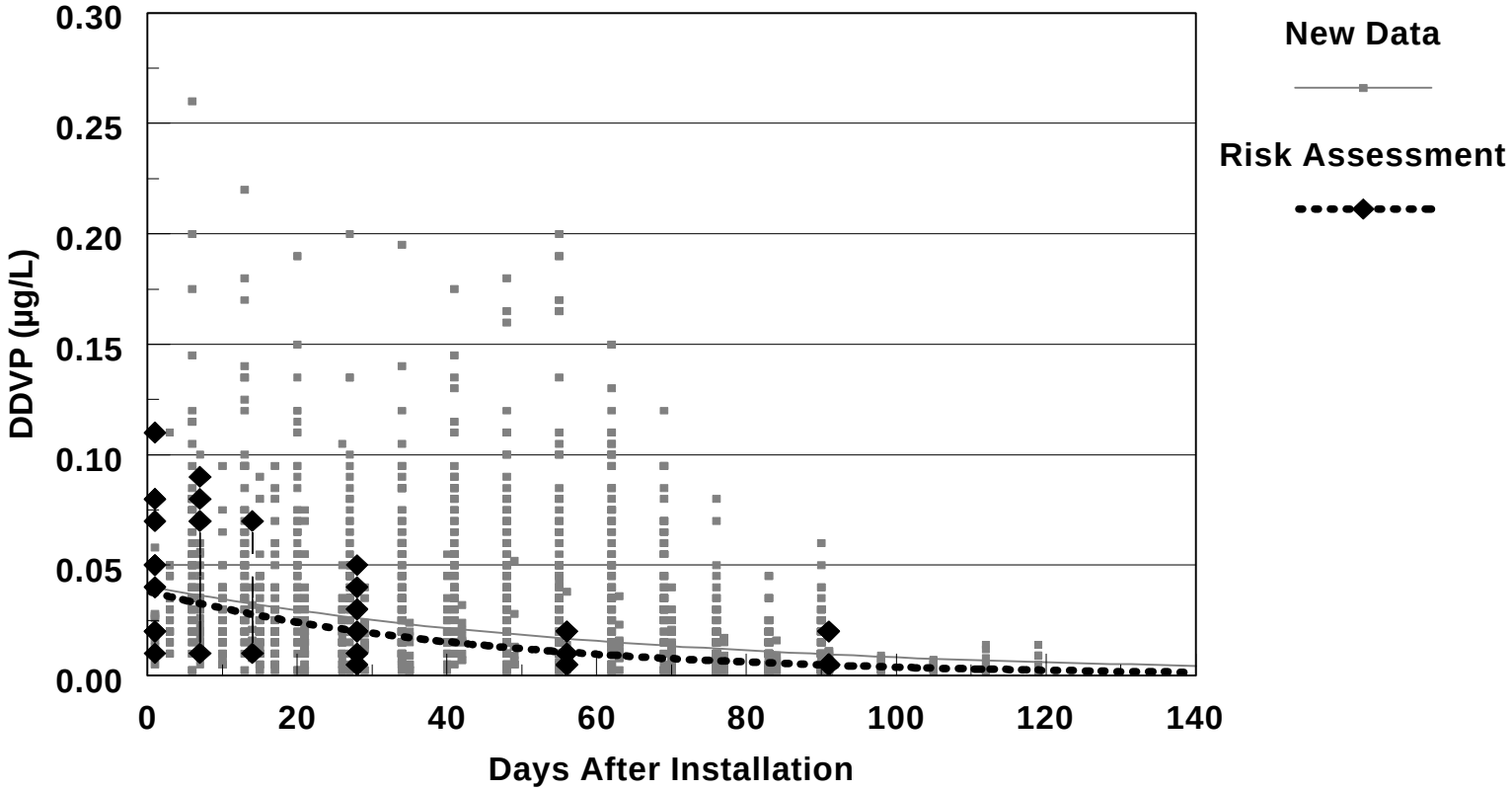
HED has examined a number of studies submitted by AMVAC Chemical Corporation. They claim that these were not considered in the risk assessment for DDVP resin strips. Some of these had previously been examined and rejected for lack of application to household resin strip use or for technical/reporting insufficiencies, although no formal reviews were written. A series of studies conducted during the development of resin strip products have been examined and compared to values used in the Agency's risk assessment. That comparison is presented in Figure 1. The individual results of the studies are included in Section 3 of this document. The risk assessment was derived from data for 15 homes in which pest strips were used under "normal conditions" in Modesto, CA (1). The recent submission includes data from over 100 homes, located in the United Kingdom and France and the United States. The data plotted in Figure 1 indicate that there is little difference between the data used by the Agency originally and the more extensive database derived from the additional data provided by the registrant.

One limited study provided by the registrant was conducted in a museum setting and indicated that the air concentrations in rooms adjacent to rooms where strip(s) are located are much lower than in the treated room. The would idicate that the spatial relations between the location of the strips and areas where activites occur could have an appreciable effect on exposure. Other studies in the submission were not considered to be relevant to this exposure scenario. These data are described in Section 3 of this document.

The submission provides an expansion of some of the studies that were examined but not used for the risk assessment for DDVP resin strips. In addition a minimal amount of spatial information was provided for museum uses. The air concentra-tions were comparable to those used in the risk assessment and therefore would result in only a minimal change in that assessment.

**Figure 1.**

**Comparison of Air Concentrations of DDVP in Homes Between the EPA Risk Assessment and New Data Submitted by the Registrant**




Hollow Squares are values used for the risk assessment

Data were collected in the United Kingdom, France, and U.S.

## 3.0 SUMMARY OF REFERENCES AND THEIR APPLICABILITY FOR INCLUSION IN THE RISK ASSESSMENT

### Zavon, M.R. and E.A. Kindel (1966), Potential Hazard in Using Dichlorvos Insecticide Resin. IN: Organic Pesticides in the Environment, A.A. Rosen and H.F. Kraybill Eds. ACS Symposium 60, American Chemical Society, Washington, D.C.

The paper was designed to evaluate the degree of hazard associated with handling and use of this formulation. The study focused on the plasma and RBC cholinesterase values of two groups, one handling the strips for 30 minutes per day for and the other with the product taped to the skin of their forearms for 30 minutes on 5 consecutive days. Measurements were also taken on individuals in two homes in which the vaporizers were installed for 2 months. Both RBC and plasma cholinesterase were monitored in all of these subject. The authors judged that "the variations in the cholinesterase activity of the erythrocytes and plasma were not a function of the duration of exposure of the subjects." Air samples (10 $ft^3$) were collected after approximately one month in each home. The air concentrations were 0.097 $\mu$g/L and 0.087 $\mu$g/L for the two homes. Only a single value, with no qualifying information as to location or number of replicates, was provided for each home. This study was examined, but not formally reviewed, by HED prior to the 1987 exposure assessment. The study was not used for the risk assessment because it contains virtually no air monitoring data. The two values that are included in this reference, however, are fairly close to those used in the risk assessment.

### Menz. M., H. Luetkeimer, and K. Sachsse (1974) Long term Exposure of Factory Workers to Dichlorvos (DDVP) Insecticide.

Plasma cholinesterase, RBC cholinesterase, and other blood parameters were monitored in thirteen adult workers (11 males and 2 females, age 20 to 67) involved in production or processing of DDVP. The study showed slight inhibition of cholinesterase with no other clinical effect resulting from exposures of approximately 0.7 $mg/m^3$ (approximately 7 times the largest measured in the Collins and Devries study used for the risk assessment,1). The study had not been submitted to the Agency for the risk assessment but would not have been used for residential risk analysis since the study does not address the home use of strip formulations of DDVP and is confined to the factory setting only.

**Hayes, A.L., R.A. Wise and F.W. Weir (1980) Assessment of Occupational Exposure to Organophosphates in Pest Control Operators. Am. Ind Hyg Assoc. J (41); 568-575.**

Exposures of 28 persons to 3 organophosphates working in a pest control establishment (22 pest control operators, a supervisor, a salesman, and a manager) to 3 organophosphates (DDVP, Diazinon, Chlorpyrifos) were monitored before, during and after an 8-hour work shift. Plasma cholinesterase, RBC cholinesterase, and urinary metabolites were measured. Eight hour air samples (2-3 replicates) were collected in the breathing zone of each worker. The pesticides concentrations were 131 µg/$m^3$ for DDVP, 41 µg/$m^3$ for Diazinon, and 27 µg/$m^3$ for Chlorpyrifos. The level of DDVP is comparable to the highest level found in the resin strip study used for the risk assessment. This paper contains insufficient data for risk assessment since there were a limited number of samples and the results are confounded by exposure to a mixture of chemicals, not just DDVP. Furthermore, it does not address the residential resin strip use.

**Deer, H.M., E.D. Beck and A.H. Roe (1993) Respiratory Exposure of Museum Personnel to Dichlorvos Insecticide. Vet. Hum. Toxicol 35(3):226-228.**

The study measured air levels in museum rooms when the ventilation system was turned on and turned off. Five air samples were collected; two air samples on subsequent days in 2 specimen rooms (250 and 250A). The ventilation system was turned off on the first day and turned on the second day. Samples were also collected in an adjacent room in which DDVP strips were not used (260). Samples were collected for 7 hours by drawing air through XAD-2 adsorbent tubes at a rate of 1 liter per minute. Samples were desorbed with toluene and analyzed by gas chromatography using a flame photometric detector, according to a standard OSHA Method. The level of reliable quantitation was 0.0019 mg/$m^3$ (0.0019 $\mu$g/L) The results of sampling are presented in Table 1. Levels were below the ACGIH established TLVs. Air levels in adjacent rooms were much less than those in which the product was used. The authors calculated time-weighted average (TWA) exposure levels for two worker groups; a full time worker in the collection area for 2 hours per day and 6 hours in the non-treated area; and a part-time worker spending 2 hours per day in the collection area only. The 8-hour TWA for the full time worker under unventilated conditions in the collection room was:

$$\text{Exposure Level (mg/m}^3\text{)} = \frac{2\text{ hr} \times 0.015\text{ mg/m}^3 + 6\text{ hr} \times 0.002\text{ mg/m}^3}{8\text{ hr}} = 0.0053\text{ mg/m}^3$$

For a 70 kg worker performing light tasks (breathing rate = 1.7 $m^3$/hr) this becomes:

Exposure (mg/kg/day) = 0.0053 mg/$m^3$ x 1.7 $m^3$/hr x 8 hr/day x 1/70 kg

= 0.0010 mg/kg/day = 1.0 $\mu$g/kg/day

Using a chronic respiratory NOAEL of 0.05 mg/kg/day, the resulting MOE is 50.

The corresponding 8-hour TWA for the part time worker was:

$$\text{Exposure Level (mg/m}^3\text{)} = \frac{\text{2 hr x 0.015 mg/m}^3\text{ + 6 hr x 0.000 mg/m}^3}{\text{8 hr}} = 0.0038 \text{ mg/m}^3$$

Exposure (mg/kg/day) = 0.0038 mg/$m^3$ x 1.7 $m^3$/hr x 8 hr/day x 1/70 kg

= 0.00074 mg/kg/day = 0.74 $\mu$g/kg/day

If the collection room is **ventilated**, the corresponding values are:

**Full Time:**

$$\text{Exposure Level (mg/m}^3\text{)} = \frac{\text{2 hr x 0.006 mg/m}^3\text{ + 6 hr x 0.002 mg/m}^3}{\text{8 hr}} = 0.0030 \text{ mg/m}^3$$

Exposure (mg/kg/day) = 0.0030 mg/$m^3$ x 1.7 $m^3$/hr x 8 hr/day x 1/70 kg

= 0.00058 mg/kg/day = 0.58 $\mu$g/kg/day

**Part Time:**

$$\text{Exposure Level (mg/m}^3\text{)} = \frac{\text{2 hr x 0.006 mg/m}^3\text{ + 6 hr x 0.000 mg/m}^3}{\text{8 hr}} = 0.0015 \text{ mg/m}^3$$

Exposure (mg/kg/day) = 0.0015 mg/$m^3$ x 1.7 $m^3$/hr x 8 hr/day x 1/70 kg

= 0.00029 mg/kg/day = 0.29 $\mu$g/kg/day

If the individuals spent all of the time in the adjacent room, the exposures are:

For the full time worker:

Exposure (mg/kg/day) = 0.002 mg/$m^3$ x 1.7 $m^3$/hr x 8 hr/day x 1/70 kg

= 0.00039 mg/kg/day = 0.39 $\mu$g/kg/day

The above calculations indicate that the a large part of the exposure (and risk) comes from the time an individual is in the room where the strips are located, even if that time is relatively short compared to time spent away from the strips. The value measured in the room adjacent those in which the pest strip was used (unventilated) was approximately 14 percent of that found in the treated room. If ventilation is used the value is on third of the treated room value. It is evident that both time spent around the strips and degree of ventilation are the most important factors contributing to exposure. It is not clear how well museum ventilation and use pattern reflects that for residential uses.

Table 1. Results of Air Sampling of Museum Rooms for DDVP While Resin Strips are being Used.

| Room | DDVP Used | Ventilation | DDVP (g/sample) | DDVP ($mg/m^3$, $\mu g/L$) |
|---|---|---|---|---|
| 250 (by desk) | Yes | Off | 5.7 | 0.13 |
| 250A (by collection drawers) | Yes | Off | 6.4 | 0.15 |
| **MEAN** | | | **6.1** | **0.14** |
| 250 (by desk) | Yes | On | 2.8 | 0.006 |
| 250A (by collection drawers) | Yes | On | 2.7 | 0.006 |
| **MEAN** | | | **2.8** | **0.006** |
| 260C (by desk) | No | On | 0.8 | 0.002 |
| Blank | N/A | N/A | ND | ND |

Limit of Detection = 0.7 g/sample
ND = None detected

**Gold, R.E. and T. Holcslaw (1985) Dermal and Respiratory Exposure of Applicators and Residents to Dichlorvos-Treated Residences. IN: Dermal Exposure Related to Pesticide Use. R.C. Honeycutt, G. Zweig and N. Ragsdale Eds. ACS Symposium 273, American Chemical Society, Washington, D. C.**

**Gold, R.E., T. Holcslaw, D. Tupy, and J. Ballard (1984) Dermal and Respiratory Exposure to Applicators and Occupants of Residences Treated with Dichlorvos (DDVP). Journal of Economic Entomology. 77(2); pp 430-436.**

Both of the above citations refer to the same study. Exposures of applicators were monitored during crack and crevice application of DDVP to homes. Environmental samples were also collected following these treatments. Cholinesterase evaluations were performed on the applicators. This study was used in 1987 for estimation of applicator exposure but has been replaced by data from PHED (2). It does not address the resin strip use. The environmental data has been replaced by information from a registrant study measuring exposure following actuation of a total release fogger. Therefore, the data in this study were not used for the risk assessment.

**Das, Y.T., P.K. Taskar, H.D. Brown and S.K. Chattopadhyay (1983) Exposure of Professional Pest Control Operators to Dichlorvos (DDVP) and Residue on House Structures. Toxicology Letters 17:pp 95-99**.

Dermal and respiratory exposures of 13 volunteers performing urban pest control tasks were monitored in 4 homes using 10-14 aerosol cans and 18-22 pints of 0.5 percent emulsion spray. Measurements were taken on the chest, back, and respirator only. Workers wore goggles, caps, respirators, coats, gloves, and shoes. Cholinesterase activity was not measured. Blood and urine analyses showed no changes in clinical chemistry or hematological parameters. Environmental monitoring included deposition samplers (gauze pads) on the floor, ceiling, cabinet, table, and closet. Air monitoring was not conducted. This study does not address the resin strip use and therefore was not used for that assessment. Better applicator data is also available from PHED and was used for that portion of the risk assessment. Better environmental data has also been submitted by the registrant and was used in the risk assessment.

**Wright, C.G. and R.B. Leidy (1980) Insecticide Residues in the Air of Buildings and Pest Control Vehicles.**

**Wright, C.G. and R.B. Leidy (1980) Air Samples in Vehicles and Buildings Turn Up Only Very Low Levels of Organic Phosphate Insecticides. Pest Control July 1980.**

Both of the above citations refer to the same study. Air concentrations of 4 organophosphate pesticides (chlorpyrifos, diazinon, malathion, and DDVP) were measured in offices, storage rooms, and in the air of vehicles used by commercial applicators. DDVP levels in offices ranged averaged 41 ng/$m^3$ (19-66 ng/$m^3$) in offices and 617 ng/$m^3$ (147-1501) in storage facilities. Measurements in vehicles averaged 110 ng/$m^3$ (16-231). air was monitored in 6 food preparation-serving areas following crack and crevice treatment, a use which as since been deleted. This study does not address the resin strip use but only those in office and storage facilities of pest control buildings, pest control vehicles, and crack and crevice treatment of food preparation-serving areas and therefore was not used for the risk assessment.

**Cavagna, G., G. Locati, and E.C. Vigliani (1969) Clinical Effects of Exposure to DDVP Vapona) in Hospital Wards. Arch. Environ Health, 18:112-123.**

Plasma and RBC cholinesterase levels and other clinical measurements were determined 250 male and 100 female healthy adults. The measurements were then conducted in sick adult and child patients and healthy pregnant women during labor and just after giving birth in rooms in which pest strips were hung. Moderate decreases in plasma cholinesterase were detected in subjects exposed to DDVP at a concentration of 0.1 mg/$m^3$ (0.1 µg/L) and in patients with liver insufficiency. This is approximately the highest concentration found in the resin strip study used for the risk assessment. Red cell cholinesterase was not affected at these concentrations. Graphs of air concentrations, but not tables were included in the paper. DDVP was determined by drawing air through 20 ml of water at a rate of 2 liters per minute. DDVP is not currently allowed in hospital wards. This study does not address the resin strip use in the residential environment, only in hospitals which have different ventilation characteristics than homes.

**Cavagna, G., G. Locati, and E.C. Vigliani (1970) Exposure of newborn babies to Vapona insecticide. European Journal of Toxicology. Jan/Feb, pp 49-57.(Abstract in Toxicol. Applied Pharm V19(2), 1971)**

The study was conducted on 89 healthy babies born of women who had normal pregnancies and deliveries. Of these 25 were born of women exposed to DDVP during labor and immediately after giving birth. The pest strips (18.8% DDVP at a rate of 1 per

30-40 $m^3$) were hung on the walls of a nursery and in the delivery room. The babies were exposed for about 20 minutes, 6 times per day during feeding. Concentrations at these times ranged from 0.095 to 0.25 $mg/m^3$. The babies were also exposed in the nursery for about 2 days during which DDVP pest strips were used. The method of analysis or air concentrations was not described. Cholinesterase measurements were taken on the newborns and anticholinesterase measurements were conducted on mothers milk. For babies exposed to DDVP concentrations ranging from 0.027 to 0.128 $mg/m^3$ the cholinesterase values were: plasma 16.17 ± 4.71, red cells 29.9 ± 7.61 at birth and plasma 17.1 ± 4.79, red cell 28.1 ± 8.12 after exposure. For babies exposed to DDVP concentrations ranging from 0.11 to 0.28 $mg/m^3$ the cholinesterase values were: plasma 12 ± 2.86, red cells 28.2 ± 4.30 at birth and plasma 13.5 ± 3.4, red cell 32 ± 3.2 after exposure. This study does not address the resin strip use in the residential environment and these products are not allowed in patient areas of hospitals.

**Uchiyama, M., T. Kawakami, and H. Hiuga (1967) Effect of Vapona/strips to human beings and the method of determination of DDVP concentration in the air.**

Plasma and RBC cholinesterase levels and other clinical measurements were determined in pediatric patients located in rooms in which pest strips were hung. Air was drawn through impingers containing water as the trapping agent. Volumes and rates were not included in the document, making it impossible to confirm the air concentration data. This study was not evaluated for the risk assessment but does not address the resin strip use in the residential environment. Air monitoring information is not adequate enough to add to the exposure assessment.

**Cervoni, W.A., J. Oliver-Gonzalez, S. Kaye and M.B. Slomka (1969) Dichlorvos as a Single Dose Intestinal Anthelmintic Therapy for Man. Am. Jour. of Tropical Medicine and Hygiene.**

The study addresses oral administration only and does not apply to the resin strip scenario.

**Pena Chavarria, A., J.C. Swartzwelder, V.M. Villarejos, E. Kotcher and J. Arguedas (1969) Dichlorvos, An Effective Broad Spectrum Anthelmintic. Am. Jour. of Tropical Medicine and Hygiene. Vol 18(6):pp 907-911.**

The study addresses oral administration only and does not apply to the resin strip scenario.

**Tracy, L.T., J.G. Woodcock, and S. Chodroff (1960) Toxicological Aspects of 2,2-Dichlorovinyl Dimethyl Phosphate (DDVP) in Cows, Horses, and White Rats.**

The study measured cholinesterase inhibition of horses and cows in a barn. Rats were treated by gavage and cows via the feed. Five horses exposed to a nominal level of 0.5 mg/ft$^3$ (0.014 mg/m$^3$) in a closed barn exhibited mild RBC cholinesterase after 22 days. DDVP was generated by sprinkling water containing 6 grams of DDVP per gallon on the central walkway of the barn. This study scenario does not address the residential use of pest strips and would add nothing to the risk assessment.

A number of studies were conducted by a previous registrant for pest strip products containing DDVP. The following studies were part of the product development for pest strip products containing DDVP. The published summary of these data is contained in the following reference. The supporting data are provided in the subsequent references which were used for product development of the DDVP strip formulation.

**Elgar. K.E. and B.D. Steer (1972) Dichlorvos Concentrations in the Air of Homes Arising from the use of Dichlorvos PVC Strips. Pestic. Sci., 3:591-600.**

Air concentrations of DDVP were monitored in homes in the United Kingdom, France and in Australia under ordinary use conditions. DDVP was measured by drawing air through a sintered-glass bubbler containing 50 mL of water at a rate 5 liters per minute. Graphs, but not individual number values were presented in the document. It was not possible to trace the individual decline pattern for any single house but rather one would have to examine trends based on pooled data. The lack of detailed information convinced HED that another literature study, used for the risk assessment, provided a better estimate of the exposures from pest strip products.

**Elgar, K.E. and B.D. Steer (1969) "Vapona" Generators - Air Concentration Studies Part IX - Vapor Generator Testing in UK, 1969. Shell Research Center Report WKGR.0159.69.**

Air monitoring was conducted in 40 houses in the United Kingdom in which pest strips containing DDVP were installed. The strips in 20 of these houses were installed by laboratory personnel and the remaining 20 applied at the discretion of the homeowner. No attempt was made to control the ventilation systems during the course of the study but the design was rather to measure concentrations under "normal" conditions. DDVP concentrations in the air were measured by drawing air through sintered-glass impingers containing distilled water as the trapping agent. Analyses of DDVP were conducted by a cholinesterase inhibition method that was not presented in detail. There were no significant differences in air concentrations between rooms in which laboratory personnel installed the strips and those in which the homeowner performed this function nor was there a trend in air concentration dependent on room size. The individual air concentrations are presented in Appendix A and graphically in Figure 2.

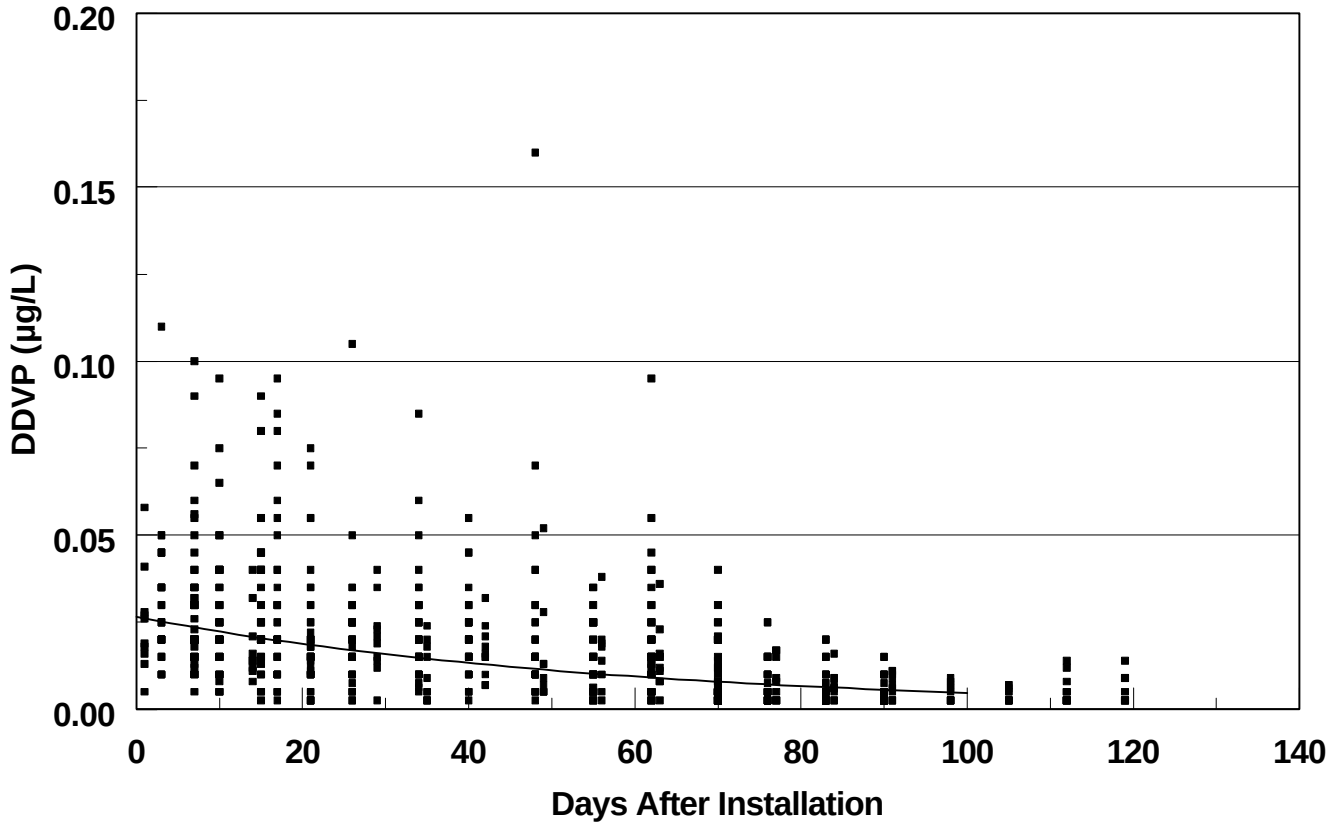
There were no appreciable differences between the concentrations found in this study and those used for HED's risk assessment.

**Elgar, K.W and Steer, B.D. (1969) "Vapona" Generators - Air Concentration Studies Part X - Vapor Generator Testing in France - September - December 1969. Shell Research Center Report WKGR.0027.70.**

Resin strips containing DDVP were installed in 54 homes in France in order to evaluate the performance of three different generators under normal use conditions. In some cases strips were installed in more than one room. The strips were installed in one or more of the following rooms; living room, dining room, kitchen, and/or bedroom. The air monitoring data are presented in Appendix B and graphically in Figure 3. There were no appreciable differences between the concentrations found in this study and those used for HED's risk assessment.

## Figure 2.

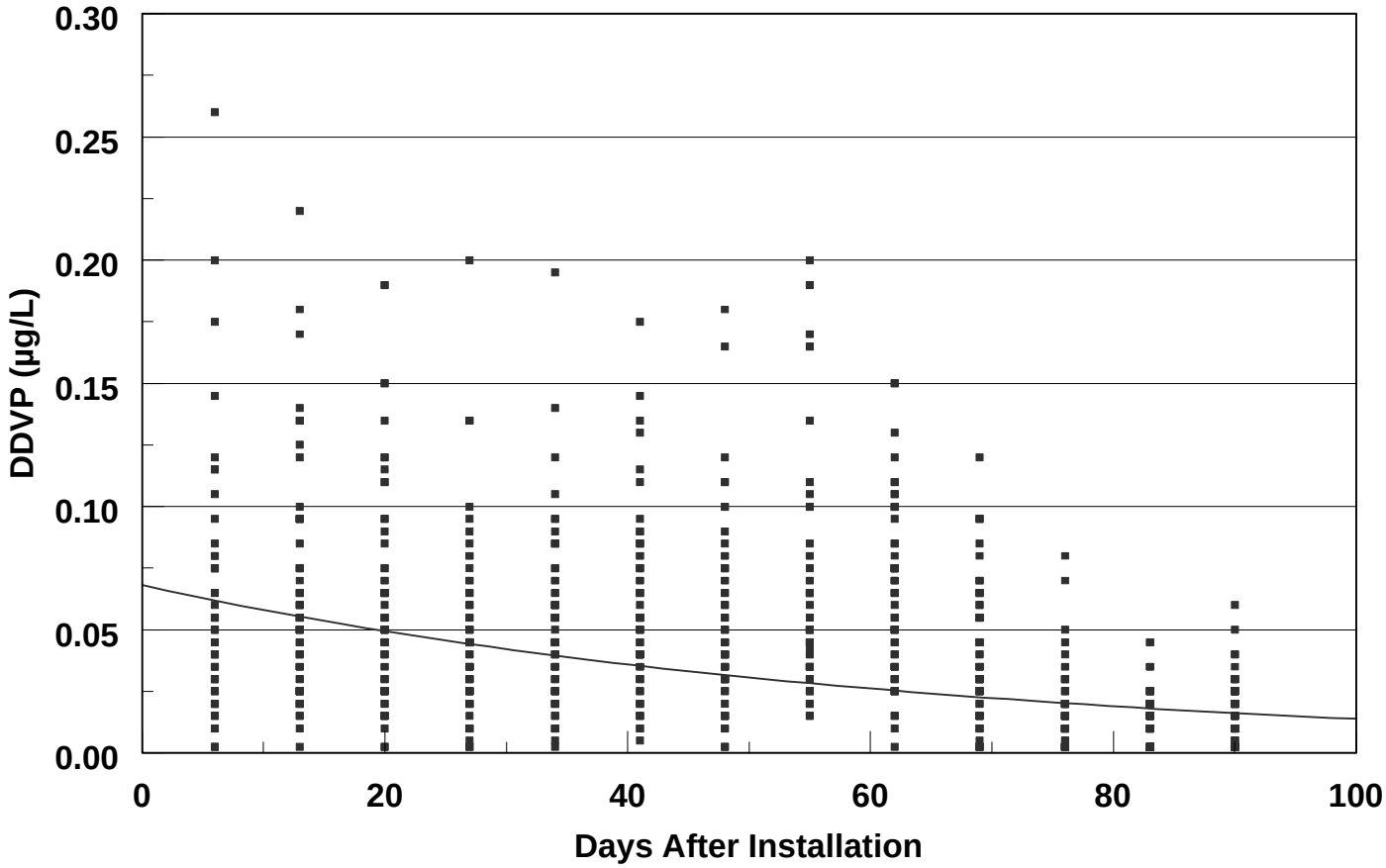
## Air Concentrations of DDVP in Homes in the United Kingdom in Which Pest Strips Were Installed




Compilation of studies by Elgar, Steer, and Davies (Described in text)

**Figure 3.**

**Air Concentrations of DDVP in Homes in France in Which Pest Strips Were Installed**



**Elgar, K.E. (1968) Vapona generators -air concentration studies Part I - Vapona Strip (AC 6750) - effect of temperature and humidity. Woodstock Agricultural Research Centre. WK.TR.0004/68**.

These studies were conducted in closed unventilated rooms at various temperatures. They do not address the residential use of pest strips under normal conditions.

**Elgar, K.E., B.L. Mathews, and P. Bosio (1972) Vapona Strips in Shops - Residues in Foodstuffs. Environmental Quality and Safety. V1:217-221.**

This publication addresses potential contamination of food only, not air concentrations. It would add no appreciable information for use in the risk assessment.

**Feichtmeir, E.F, L. Hirsch, and E.M. Lavor (1970) The third Arizona Home Study - The Quantitation of DDVP Residues in Foods Consumed by Human Volunteers Exposed to No-Pest® Strip Insecticide. Shell Chemical Company. (Abstract in Toxicol. Applied Pharm V19(2), 1971)**

The study contains air monitoring data, food residue analyses, and clinical parameters (including cholinesterase) for 6 homes in Arizona. Air concentrations were presented in graphical format only but are comparable to those being used for the risk assessment. After 28 days a new installation at twice the current label rate was made in the kitchen only. Locations of installation in other rooms was not specified. The results of this study would add no appreciable information to the risk assessment for resin strip products.

**Davies, L. and A.P. Woodbridge (1979) The Performance of Modified Dichlorvos/PVC Slow-Release Matrices - A review of the 1973 and 1974 Experimental Programme. Shell Biosciences Laboratory. BLTN.79.082.**

The above reports attempts to develop improved matrices for resin strips Performance of different strip and cassette materials were evaluated in test rooms under extreme conditions of temperature. They contain individual measurements that could be used to derive decline equations, assuming that the formulations are similar to those currently in use. Strips were then installed in 10 homes and air samples were collected weekly for 119 days. The values reported are comparable to those currently being used in the risk assessment. The results of sampling are presented in Appendix C and included in Figure 2.

**Collins, R.D. and D.M. Devries (1971) Determination of Vapona Insecticide Residues in Air and Food from Homes Treated with Open/Close Devices - 1971 Modesto Home Study. Shell Development Company Technical Progress Report No. M-2-72.**

This study examines a change in the packaging for pest strips in which the cage containing the strip can be opened or closed at will. The study was conducted in 10 homes. Participants closed the cages upon arising and open them again after dinner. Air concentrations were generally lower but within the same range as those used for the risk assessment. HED knows of no current products that use open/close devices.

**Collins, R.D. and D.M. Devries (1971) Determination of Vapona Insecticide Residues in Air and Food from Homes Treated with No-Pest® - II Modesto Home Study. Shell Development Company Technical Progress Report No. M-2-72.**

This study is an expanded version of the Collins and Devries study that is being used in the risk assessment. It contains much more detail on the construction of the houses and placement of the pest strips It does not provide new air monitoring data.

**Lewis, R.G., A. Bond, D.E. Johnson and J.P. Hsu (1988) Measurement of Atmospheric Concentrations of Common Household Pesticides: A Pilot Study. Environmental Monitoring and Assessment 10:59-73.**

This paper describes the early stages of NOPES, explaining the house classification and chemicals being monitored. There are no quantitative air monitoring data for DDVP in this document.

**Whitmore, R.W., F.W. Immerman, D.E. Camann, A.E. Bond, R.G. Lewis and J.L. Schaum (1994) Non-Occupational Exposures to Pesticides for Residents of Two U.S. Cities. Arch. Environ. Contam. Toxicol 26:47-59.**

The paper describes the results of NOPES. The levels estimated by the investigators are much less than those predicted by the model in the risk assessment. The investigators considered non-detect samples to be 0 which they admit may bias the figures downward somewhat. Since DDVP was not detected in many homes this could be important. Also the treatment histories are not known for these homes.

**EPA (1990) Non Occupational Pesticide Exposure Study (NOPES). EPA/600/3-90/003.**

This is the full report for the paper described above. The study was not designed for risk assessment and does not contain sufficient historical, activity, of house profile data for this purpose.

## ADDITIONAL REFERENCES

1) Collins, R.D. and D.M. DeVries (1973) Air concentrations and Food Residues from Use of Shell's No-Pest Insecticide Strip. Bull. Environ. Contamin. Toxicol. 9(4):227-233.

2) Pesticide Handlers Exposure Database (PHED) Version 1.1, March 1995.

cc: Dichlorvos File/084001
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# Response to AMVAC Literature Submission for DDVP - Appendices

## Appendix A. Air Concentrations of DDVP in Homes in the United Kingdom Where Pest Strips Were Installed. L = Living Room/Lounge, D = Dining Room, K = Kitchen

| House No. | Room(s) | Vol ($ft^3$) | No. Strips | $ft^3$/strip | Days After Installation of Strips | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 3 | 7 | 10 | 15 | 17 | 21 | 24-28 | 31-36 | 38-41 | 45-50 | 52-57 | 59-64 | 66-71 | 73-78 | 80-85 | 87-92 |
| 4 | L/K/D | 3400 | 3 | 1133 | 0.0250 | 0.0300 | 0.0500 | 0.0450 | 0.0300 | 0.0200 | 0.0300 | 0.0300 | 0.0200 | 0.0300 | 0.0200 | 0.0450 | 0.0050 | 0.0050 | 0.0100 | 0.0100 |
| 6 | K | 1020 | 1 | 1020 | 0.0100 | 0.0100 | 0.0200 | 0.0100 | 0.0100 | 0.0050 | 0.0050 | 0.0100 | 0.0025 | 0.0050 | 0.0025 | 0.0050 | 0.0050 | 0.0150 | 0.0025 | 0.0050 |
| 8 | K/D | 2180 | 2 | 1090 | 0.0350 | 0.0450 | 0.0400 | 0.0450 | 0.0200 | 0.0250 | 0.0250 | 0.0350 | 0.0250 | 0.0150 | 0.0150 | 0.0200 | 0.0050 | 0.0150 | 0.0150 | 0.0100 |
| 9 | B | 890 | 1 | 890 | 0.0450 | 0.0200 | 0.0100 | 0.0200 | 0.0800 | 0.0150 | 0.0100 | 0.0150 | 0.0150 | 0.0100 | 0.0300 | 0.0350 | 0.0200 | 0.0150 | 0.0200 | 0.0100 |
| 10 | B | 990 | 1 | 990 | 0.0200 | 0.0200 | 0.0300 | 0.0250 | 0.0300 | 0.0100 | 0.0250 | 0.0150 | 0.0200 | 0.0100 | 0.0250 | 0.0050 | 0.0250 | 0.0250 | 0.0200 | 0.0150 |
| 11 | L/D | 1720 | 2 | 860 | 0.0250 | 0.0550 | 0.0400 | 0.0350 | 0.0150 | 0.0550 | 0.0300 | 0.0300 | 0.0300 | 0.0100 | 0.0250 | 0.0200 | 0.0025 | 0.0100 | 0.0100 | 0.0050 |
| 13 | L/D | 1315 | 1 | 1315 | 0.0200 | 0.0200 | 0.0150 | 0.0150 | 0.0050 | 0.0100 | 0.0100 | 0.0100 | 0.0100 | 0.0100 | 0.0050 | 0.0050 | 0.0025 | 0.0025 | 0.0025 | 0.0025 |
| 14 | K | 820 | 1 | 820 | 0.0450 | 0.0900 | 0.0200 | 0.0150 | 0.0950 | 0.0150 | 0.0250 | 0.0150 | 0.0200 | 0.0100 | 0.0250 | 0.0250 | 0.0050 | 0.0050 | 0.0200 | 0.0150 |
| 15 | K | 560 | 1 | 560 | 0.0250 | 0.0200 | 0.0300 | 0.0200 | 0.0300 | 0.0200 | 0.0200 | 0.0500 | 0.0150 | 0.0100 | 0.0100 | 0.0150 | 0.0050 | 0.0050 | 0.0150 | 0.0025 |
| 16 | K/D | 2080 | 2 | 1040 | 0.0450 | 0.0350 | 0.0750 | 0.0800 | 0.0500 | 0.0200 | 0.0250 | 0.0250 | 0.0250 | 0.0100 | | 0.0300 | 0.0050 | 0.0100 | 0.0050 | 0.0025 |
| 21 | L/K/D | 3400 | 3 | 1133 | 0.0200 | 0.0200 | 0.0400 | 0.0200 | 0.0200 | 0.0400 | 0.0200 | 0.0400 | 0.0450 | 0.0200 | 0.0250 | 0.0200 | 0.0025 | 0.0100 | | 0.0025 |
| 23 | LOUNGE | 1010 | 1 | 1010 | 0.0350 | 0.0200 | 0.0050 | 0.0050 | 0.0100 | 0.0150 | 0.0050 | 0.0150 | 0.0200 | 0.0250 | 0.0100 | 0.0300 | 0.0050 | 0.0100 | 0.0150 | 0.0050 |
| 25 | K | 945 | 1 | 945 | 0.0150 | 0.0350 | 0.0150 | 0.0200 | 0.0100 | 0.0150 | 0.0200 | 0.0200 | 0.0100 | 0.0150 | 0.0100 | 0.0150 | 0.0050 | 0.0050 | 0.0050 | 0.0025 |
| 27 | B | 1100 | 1 | 1100 | 0.0200 | 0.0100 | 0.0150 | 0.0200 | 0.0150 | 0.0100 | 0.0250 | 0.0100 | 0.0050 | 0.0150 | 0.0150 | 0.0050 | 0.0200 | 0.0050 | 0.0025 | 0.0025 |
| 29 | B | 1260 | 1 | 1260 | 0.0100 | 0.0100 | 0.0050 | 0.0050 | 0.0050 | 0.0025 | 0.0100 | 0.0100 | 0.0200 | 0.0050 | 0.0050 | 0.0025 | 0.0050 | 0.0050 | | 0.0025 |
| 30 | K | 1000 | 1 | 1000 | 0.0150 | 0.0200 | 0.0050 | 0.0200 | 0.0250 | 0.0100 | 0.0150 | 0.0100 | 0.0100 | 0.0100 | 0.0100 | 0.0100 | 0.0200 | 0.0050 | 0.0025 | 0.0050 |
| 33 | B | 725 | 1 | 725 | 0.0350 | 0.0300 | 0.0350 | 0.0400 | 0.0600 | 0.0750 | 0.0350 | 0.0600 | 0.0450 | 0.0500 | 0.0350 | 0.0550 | 0.0200 | 0.0150 | 0.0100 | 0.0050 |
| 37 | K | 785 | 1 | 785 | 0.0500 | 0.0300 | 0.0250 | 0.0250 | 0.0250 | 0.0350 | 0.0300 | 0.0200 | 0.0200 | 0.0150 | 0.0100 | 0.0250 | 0.0050 | 0.0100 | 0.0050 | 0.0100 |
| 38 | K | 780 | 1 | 780 | | 0.0150 | 0.0200 | 0.0250 | 0.0200 | 0.0150 | 0.0250 | 0.0300 | 0.0150 | 0.0200 | 0.0100 | 0.0200 | 0.0050 | 0.0025 | 0.0050 | 0.0025 |
| 40 | LOUNGE | 900 | 1 | 900 | 0.0250 | 0.0200 | 0.0400 | 0.0400 | 0.0300 | 0.0200 | 0.0500 | 0.0250 | 0.0250 | 0.0700 | 0.0250 | 0.0400 | 0.0200 | 0.0050 | 0.0100 | 0.0100 |
| 1 | D | 1395 | 1 | 1395 | 0.0100 | 0.0150 | 0.0200 | 0.0100 | 0.0050 | 0.0100 | 0.0100 | 0.0150 | 0.0050 | 0.0150 | 0.0050 | 0.0150 | 0.0025 | 0.0025 | 0.0025 | 0.0025 |
| 5 | K | 1010 | 1 | 1010 | 0.0200 | 0.0300 | 0.0300 | 0.0200 | 0.0200 | 0.0150 | 0.0250 | 0.0200 | 0.0250 | 0.0100 | 0.0150 | 0.0025 | 0.0050 | 0.0025 | 0.0025 | 0.0025 |
| 7 | K | 840 | 1 | 840 | 0.0300 | 0.0500 | 0.0250 | 0.0200 | 0.0150 | 0.0150 | 0.0150 | 0.0300 | 0.0100 | 0.0100 | 0.0050 | 0.0150 | 0.0025 | 0.0150 | 0.0025 | 0.0050 |
| 17 | K | 900 | 1 | 900 | 0.0350 | 0.0700 | 0.0500 | 0.0150 | 0.0350 | 0.0100 | 0.0025 | 0.0050 | 0.0200 | 0.0150 | 0.0025 | 0.0100 | 0.0025 | 0.0025 | 0.0025 | |
| 18 | K | 966 | 1 | 966 | 0.0300 | 0.0150 | 0.0150 | 0.0300 | 0.0100 | 0.0100 | 0.0150 | 0.0100 | 0.0250 | 0.0050 | 0.0100 | 0.0050 | 0.0025 | 0.0100 | 0.0025 | 0.0025 |
| 19 | K | | | | 0.0450 | 0.0350 | 0.0650 | 0.0550 | 0.0550 | 0.0300 | 0.1050 | 0.0350 | 0.0350 | 0.0050 | 0.0150 | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.0025 |
| 20 | K | 1380 | 1 | 1380 | 0.0500 | 0.0200 | 0.0200 | 0.0400 | 0.0200 | 0.0200 | 0.0150 | 0.0300 | 0.0250 | 0.0150 | 0.0150 | 0.0150 | 0.0050 | 0.0025 | 0.0025 | 0.0025 |
| 26 | L | 1500 | 1 | 1500 | 0.0150 | 0.0400 | 0.0100 | 0.0200 | 0.0400 | | 0.0100 | 0.0150 | 0.0150 | 0.0150 | 0.0050 | 0.0150 | 0.0050 | 0.0025 | 0.0100 | 0.0025 |
| 28 | K | 490 | 1 | 490 | 0.0100 | 0.0300 | 0.0100 | 0.0100 | 0.0100 | 0.0050 | 0.0025 | 0.0100 | 0.0050 | 0.0100 | 0.0050 | 0.0150 | 0.0050 | | 0.0025 | 0.0050 |
| 31 | K | 950 | 1 | 950 | 0.0200 | 0.0050 | 0.0200 | 0.0450 | 0.0850 | 0.0550 | 0.0100 | 0.0200 | 0.0200 | 0.0400 | 0.0100 | 0.0200 | 0.0100 | 0.0025 | 0.0050 | 0.0050 |
| 32 | K | 770 | 1 | 770 | 0.0350 | 0.0400 | 0.0400 | 0.0450 | 0.0300 | 0.0250 | 0.0150 | 0.0200 | 0.0300 | 0.0300 | 0.0250 | 0.0400 | 0.0025 | 0.0100 | 0.0150 | 0.0050 |
| 34 | K | 740 | 1 | 740 | 0.1100 | 0.1000 | 0.0950 | 0.0900 | 0.0700 | 0.0700 | 0.0150 | 0.0850 | 0.0550 | 0.1600 | 0.0350 | 0.0950 | 0.0400 | 0.0250 | 0.0100 | 0.0025 |
| 35 | K | 690 | 1 | 690 | 0.0300 | 0.0350 | 0.0350 | 0.0400 | 0.0400 | 0.0300 | 0.0350 | 0.0250 | 0.0300 | 0.0400 | 0.0150 | 0.0250 | 0.0300 | 0.0050 | 0.0100 | 0.0100 |
| 39 | H | 1450 | 1 | 1450 | 0.0200 | 0.0100 | 0.0200 | 0.0100 | 0.0150 | 0.0100 | 0.0300 | 0.0200 | | 0.0250 | 0.0100 | 0.0050 | 0.0025 | 0.0025 | 0.0050 | 0.0025 |
| 2 | L/D | 2260 | 1 | 2260 | 0.0150 | 0.0150 | 0.0080 | 0.0025 | 0.0025 | 0.0025 | 0.0075 | 0.0063 | 0.0100 | 0.0025 | 0.0025 | 0.0130 | 0.0050 | 0.0025 | 0.0075 | 0.0038 |
| 3 | L/K/D | 3360 | 1 | 3360 | 0.0200 | 0.0200 | 0.0250 | 0.0130 | 0.0200 | 0.0025 | 0.0150 | 0.0100 | 0.0100 | 0.0300 | 0.0200 | 0.0130 | 0.0250 | 0.0075 | 0.0038 | 0.0100 |
| 22 | L/D | 1740 | 1 | 1740 | 0.0200 | 0.0200 | 0.0100 | 0.0250 | 0.0100 | 0.0150 | 0.0050 | 0.0075 | 0.0150 | 0.0200 | 0.0100 | 0.0120 | 0.0038 | | 0.0050 | 0.0075 |
| 24 | D | 1620 | 1 | 1620 | 0.0350 | 0.0200 | 0.0100 | 0.0200 | 0.0200 | 0.0180 | 0.0180 | 0.0150 | 0.0200 | 0.0100 | 0.0063 | 0.0100 | 0.0038 | 0.0150 | 0.0075 | 0.0038 |
| 12 | L/D | 1740 | 1 | 1740 | 0.0100 | 0.0150 | 0.0150 | 0.0200 | 0.0100 | 0.0150 | 0.0200 | 0.0150 | 0.0150 | 0.0150 | 0.0050 | 0.0100 | 0.0025 | 0.0150 | 0.0025 | 0.0025 |
| 36 | D | 1620 | 1 | 1620 | 0.0100 | 0.0200 | 0.0250 | 0.0200 | 0.0200 | 0.0350 | 0.0200 | 0.0250 | 0.0150 | 0.0100 | 0.0100 | 0.0100 | 0.0050 | 0.0050 | 0.0050 | 0.0100 |

# Response to AMVAC Literature Submission for DDVP - Appendices

## Response to AMVAC Literature Submission for DDVP - Appendices

### Appendix B. Air Concentrations of DDVP in Homes in the France Where Pest Strips Were Installed. L = Living Room/Lounge, D = Dining Room, K = Kitchen

| House No. | TYPE OF STRIP | Room | Vol ($m^3$) | Vol ($ft^3$) | No. Strips | $ft^3$/strip | 5-7 Days | 12-14 Days | 19-21 Days | 26-28 Days | 33-35 Days | 40-42 Days | 47-49 Days | 54-56 Days | 61-63 Days | 68-70 Days | 75-77 Days | 82-84 Days | 89-91 Days |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AC 6750 | B | 31 | 1094 | 1 | 1094 | 0.055 | 0.06 | 0.04 | 0.005 | 0.01 | 0.055 | 0.05 | 0.04 | 0.055 | 0.03 | 0.015 | 0.01 | 0.02 |
| 7 | AC 6750 | L | 35 | 1236 | 1 | 1236 | 0.045 | 0.05 | 0.02 | 0.025 | 0.045 | 0.08 | 0.0025 | 0.165 | 0.025 | 0.025 | 0.01 | 0.0025 | 0.005 |
| 20 | AC 6750 | L | 58 | 2047 | 2 | 1024 | 0.05 | 0.055 | 0.04 | 0.045 | 0.035 | 0.04 | 0.03 | 0.025 | 0.025 | 0.015 | 0.025 | 0.0025 | 0.015 |
| 23 | AC 6750 | D | 48 | 1694 | 2 | 847 | 0.025 | 0.05 | 0.035 | 0.03 | 0.02 | 0.05 | 0.035 | | | | | | |
| 24 | AC 6750 | K | 16 | 565 | 1 | 565 | 0.055 | 0.05 | 0.025 | 0.045 | 0.055 | 0.02 | 0.035 | 0.05 | 0.045 | 0.045 | 0.01 | 0.015 | 0.01 |
| 24 | AC 6750 | B | 23 | 812 | 1 | 812 | 0.065 | 0.095 | 0.065 | 0.075 | 0.06 | 0.07 | 0.045 | 0.065 | 0.085 | 0.055 | 0.02 | 0.01 | 0.0025 |
| 29 | AC 6750 | L | 24 | 847 | 1 | 847 | 0.145 | 0.135 | 0.19 | 0.135 | 0.025 | 0.11 | 0.075 | 0.035 | 0.11 | 0.085 | 0.045 | 0.015 | 0.025 |
| 30 | AC 6750 | B | 35 | 1236 | 1 | 1236 | 0.04 | 0.035 | 0.045 | 0.02 | 0.035 | 0.04 | 0.03 | 0.02 | 0.055 | 0.0025 | 0.005 | 0.01 | 0.01 |
| 32 | AC 6750 | B | 26 | 918 | 1 | 918 | 0.03 | 0.025 | 0.03 | 0.03 | 0.06 | 0.055 | 0.055 | 0.035 | 0.03 | 0.045 | 0.02 | 0.0025 | 0.0025 |
| 33 | AC 6750 | L | 97 | 3424 | 3 | 1141 | 0.085 | 0.075 | 0.12 | 0.025 | 0.09 | 0.085 | 0.09 | 0.085 | 0.15 | 0.06 | 0.05 | 0.025 | 0.03 |
| 34 | AC 6750 | B | 27 | 953 | 1 | 953 | 0.175 | 0.22 | 0.19 | 0.2 | 0.195 | 0.175 | 0.18 | 0.2 | 0.12 | 0.035 | 0.08 | 0.035 | 0.04 |
| 36 | AC 6750 | K | 30 | 1059 | 1 | 1059 | 0.0025 | 0.015 | 0.025 | 0.01 | 0.005 | 0.01 | 0.01 | 0.035 | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.01 |
| 39 | AC 6750 | K | 51 | 1800 | 2 | 900 | 0.02 | 0.02 | 0.065 | 0.045 | 0.055 | 0.045 | 0.03 | 0.045 | 0.065 | 0.055 | 0.015 | 0.02 | 0.03 |
| 41 | AC 6750 | D | 41 | 1447 | 2 | 724 | 0.08 | 0.085 | 0.055 | 0.065 | 0.06 | 0.06 | 0.055 | 0.05 | 0.075 | 0.03 | 0.0025 | 0.01 | 0.025 |
| 43 | AC 6750 | K | 23 | 812 | 1 | 812 | 0.03 | 0.05 | 0.055 | 0.045 | 0.055 | 0.055 | 0.065 | 0.05 | 0.065 | 0.035 | 0.015 | 0.015 | 0.025 |
| 44 | AC 6750 | D | 46 | 1624 | 2 | 812 | 0.075 | 0.025 | 0.025 | 0.07 | 0.065 | 0.03 | 0.065 | 0.05 | 0.045 | 0.07 | 0.03 | 0.02 | 0.02 |
| 45 | AC 6750 | K | 23 | 812 | 1 | 812 | 0.075 | 0.035 | 0.04 | 0.035 | 0.075 | 0.055 | 0.04 | 0.03 | 0.07 | 0.03 | 0.015 | 0.02 | 0.025 |
| 49 | AC 6750 | L | 40 | 1412 | 1 | 1412 | 0.095 | 0.04 | 0.07 | 0.035 | 0.085 | 0.05 | 0.165 | 0.17 | 0.15 | 0.07 | 0.025 | 0.035 | 0.035 |
| 49 | AC 6750 | B | 40 | 1412 | 1 | 1412 | 0.03 | 0.06 | 0.095 | 0.035 | 0.105 | 0.055 | 0.12 | 0.1 | 0.105 | 0.04 | 0.015 | 0.015 | 0.025 |
| 53 | AC 6750 | K | 32 | 1130 | 1 | 1130 | 0.05 | 0.03 | 0.05 | 0.03 | 0.04 | 0.035 | 0.035 | 0.03 | 0.075 | 0.025 | 0.01 | 0.01 | 0.01 |
| 2 | TR-1 | K | 32 | 1130 | 1 | 1130 | 0.08 | 0.12 | 0.09 | 0.04 | 0.045 | 0.065 | 0.045 | 0.07 | 0.05 | 0.035 | 0.015 | 0.01 | 0.02 |
| 3 | TR-1 | L | 45 | 1589 | 2 | 795 | 0.08 | 0.17 | 0.085 | 0.06 | 0.06 | 0.07 | 0.075 | 0.19 | 0.08 | 0.045 | 0.035 | 0.035 | 0.05 |
| 5 | TR-1 | D | 48 | 1694 | 2 | 847 | 0.035 | 0.18 | 0.15 | 0.135 | 0.14 | 0.095 | 0.1 | 0.17 | 0.1 | 0.095 | 0.03 | 0.025 | 0.025 |
| 11 | TR-1 | L | 21 | 741 | 1 | 741 | 0.075 | 0.075 | 0.065 | 0.06 | 0.07 | 0.065 | 0.03 | 0.165 | 0.075 | 0.03 | 0.01 | 0.025 | 0.025 |
| 14 | TR-1 | L1 | 58 | 2047 | 2 | 1024 | 0.26 | 0.14 | 0.115 | 0.095 | 0.095 | 0.135 | 0.075 | 0.11 | 0.085 | 0.12 | 0.02 | 0.025 | 0.03 |
| 14 | TR-1 | L2 | 58 | 2047 | 2 | 1024 | 0.055 | 0.065 | 0.15 | 0.05 | 0.085 | 0.115 | 0.05 | 0.065 | 0.075 | 0.095 | 0.01 | 0.02 | 0.03 |
| 15 | TR-1 | B | 40 | 1412 | 1 | 1412 | 0.08 | 0.075 | 0.055 | 0.055 | 0.02 | 0.04 | 0.04 | 0.015 | 0.07 | 0.015 | 0.005 | 0.0025 | 0.01 |
| 18 | TR-1 | B | 23 | 812 | 1 | 812 | 0.115 | 0.1 | 0.095 | 0.045 | 0.065 | 0.075 | 0.085 | 0.065 | 0.1 | 0.03 | 0.02 | 0.0025 | 0.0025 |
| 19 | TR-1 | L | 73 | 2577 | 3 | 859 | 0.2 | 0.095 | 0.05 | 0.045 | 0.055 | 0.13 | 0.1 | 0.08 | 0.095 | 0.08 | 0.01 | 0.045 | 0.03 |
| 28 | TR-1 | B | 33 | 1165 | 1 | 1165 | 0.12 | 0.095 | 0.075 | 0.085 | 0.045 | 0.075 | 0.11 | 0.08 | 0.075 | 0.055 | 0.0025 | 0.015 | 0.02 |
| 28 | TR-1 | K | 24 | 847 | 1 | 847 | 0.115 | 0.055 | 0.065 | 0.055 | 0.030 | 0.055 | 0.040 | 0.070 | 0.025 | 0.055 | 0.003 | 0.003 | 0.003 |
| 37 | TR-1 | K | 23 | 812 | 1 | 812 | 0.020 | 0.055 | 0.075 | 0.020 | 0.020 | 0.035 | 0.015 | 0.015 | 0.015 | 0.010 | 0.015 | 0.010 | 0.005 |
| 38 | TR-1 | L | 34 | 1200 | 1 | 1200 | 0.075 | 0.095 | 0.135 | 0.070 | 0.060 | 0.085 | 0.070 | 0.030 | 0.035 | 0.030 | 0.025 | 0.003 | 0.003 |

## Response to AMVAC Literature Submission for DDVP - Appendices

### Appendix B. Air Concentrations of DDVP in Homes in the France Where Pest Strips Were Installed. L = Living Room/Lounge, D = Dining Room, K = Kitchen

| House No. | TYPE OF STRIP | Room | Vol ($m^3$) | Vol ($ft^3$) | No. Strips | $ft^3$/strip | 5-7 Days | 12-14 Days | 19-21 Days | 26-28 Days | 33-35 Days | 40-42 Days | 47-49 Days | 54-56 Days | 61-63 Days | 68-70 Days | 75-77 Days | 82-84 Days | 89-91 Days |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | TR-1 | B | 25 | 883 | 1 | 883 | 0.020 | 0.125 | 0.070 | 0.100 | 0.085 | 0.090 | 0.060 | 0.075 | 0.065 | 0.065 | 0.030 | 0.025 | 0.025 |
| 40 | TR-1 | K | 16 | 565 | 1 | 565 | 0.010 | 0.135 | 0.120 | 0.090 | 0.120 | 0.075 | 0.045 | 0.055 | 0.105 | 0.045 | 0.010 | 0.020 | 0.025 |
| 42 | TR-1 | K | 29 | 1024 | 1 | 1024 | 0.075 | 0.065 | 0.110 | 0.065 | 0.075 | 0.080 | 0.040 | 0.045 | 0.035 | 0.030 | 0.020 | 0.003 | 0.020 |
| 50 | TR-1 | B | 38 | 1341 | 1 | 1341 | 0.105 | 0.095 | 0.110 | 0.080 | 0.040 | 0.030 | 0.060 | 0.105 | 0.110 | 0.095 | 0.070 | 0.045 | 0.060 |
| 51 | TR-1 | K/L | 52 | 1836 | 2 | 918 | 0.040 | 0.025 | 0.015 | 0.045 | 0.035 | 0.030 | 0.030 | 0.035 | 0.025 | 0.020 | 0.020 | 0.025 | 0.040 |
| 52 | TR-1 | K | 40 | 1412 | 1 | 1412 | 0.020 | 0.020 | 0.035 | 0.010 | 0.035 | 0.020 | 0.035 | 0.035 | 0.035 | 0.025 | 0.015 | 0.003 | 0.003 |
| 52 | TR-1 | B | 30 | 1059 | 1 | 1059 | 0.035 | 0.035 | 0.045 | 0.045 | 0.070 | 0.040 | 0.025 | 0.065 | 0.075 | 0.025 | 0.003 | 0.020 | 0.025 |
| 4 | TR-2 | B | 37 | 1306 | 1 | 1306 | 0.050 | 0.040 | 0.025 | 0.035 | 0.045 | 0.040 | 0.040 | 0.100 | 0.060 | 0.055 | 0.020 | 0.015 | 0.015 |
| 6 | TR-2 | K | 41 | 1447 | 1 | 1447 | 0.010 | 0.020 | 0.065 | 0.003 | 0.040 | 0.055 | 0.050 | 0.135 | 0.035 | 0.065 | 0.035 | 0.010 | 0.015 |
| 8 | TR-2 | D | 49 | 1730 | 2 | 865 | 0.035 | 0.025 | 0.050 | 0.030 | 0.025 | 0.040 | 0.030 | 0.190 | 0.050 | 0.035 | 0.020 | 0.010 | 0.003 |
| 9 | TR-2 | K | 29 | 1024 | 1 | 1024 | 0.003 | 0.015 | 0.020 | 0.015 | 0.015 | 0.015 | 0.015 | | | 0.003 | 0.015 | 0.010 | 0.005 |
| 10 | TR-2 | B | 28 | 988 | 1 | 988 | 0.020 | 0.025 | 0.015 | 0.003 | 0.025 | 0.015 | 0.020 | 0.025 | 0.035 | 0.035 | 0.010 | 0.015 | 0.015 |
| 12 | TR-2 | K | 25 | 883 | 1 | 883 | 0.040 | 0.045 | 0.015 | 0.035 | 0.020 | 0.020 | 0.080 | 0.035 | 0.050 | 0.015 | 0.010 | 0.003 | 0.003 |
| 13 | TR-2 | K | 28 | 988 | 1 | 988 | 0.030 | 0.035 | 0.045 | 0.020 | 0.025 | 0.025 | 0.030 | 0.065 | 0.035 | 0.070 | 0.020 | 0.020 | 0.015 |
| 16 | TR-2 | B | 26 | 918 | 1 | 918 | 0.055 | 0.065 | 0.050 | 0.035 | 0.045 | 0.065 | 0.070 | 0.045 | 0.075 | 0.015 | 0.010 | 0.010 | 0.003 |
| 17 | TR-2 | L | 25 | 883 | 1 | 883 | 0.065 | 0.070 | 0.045 | 0.045 | 0.055 | 0.085 | 0.080 | 0.040 | 0.040 | 0.025 | 0.015 | 0.003 | 0.010 |
| 21 | TR-2 | B | 37 | 1306 | 1 | 1306 | 0.015 | 0.060 | 0.010 | 0.025 | 0.010 | 0.005 | 0.015 | 0.035 | 0.025 | 0.003 | 0.003 | 0.015 | 0.020 |
| 22 | TR-2 | B | 30 | 1059 | 1 | 1059 | 0.040 | 0.055 | 0.050 | 0.035 | 0.030 | 0.025 | 0.045 | 0.050 | 0.100 | 0.060 | 0.003 | 0.003 | 0.010 |
| 25 | TR-2 | D | 49 | 1730 | 2 | 865 | 0.035 | 0.045 | 0.050 | 0.025 | 0.035 | 0.035 | 0.035 | 0.045 | 0.040 | 0.065 | 0.030 | 0.003 | 0.003 |
| 26 | TR-2 | B | 40 | 1412 | 1 | 1412 | 0.060 | 0.050 | 0.015 | 0.040 | 0.030 | 0.050 | 0.040 | 0.025 | 0.070 | 0.040 | 0.030 | 0.015 | 0.010 |
| 27 | TR-2 | B | 20 | 706 | 1 | 706 | 0.055 | 0.010 | 0.025 | 0.025 | 0.015 | 0.090 | 0.015 | 0.030 | 0.015 | 0.015 | 0.003 | 0.015 | 0.020 |
| 27 | TR-2 | K | 21 | 741 | 1 | 741 | 0.035 | 0.003 | 0.003 | 0.010 | 0.003 | 0.010 | 0.010 | 0.020 | 0.030 | 0.010 | 0.003 | 0.010 | 0.015 |
| 31 | TR-2 | K | 17 | 600 | 1 | 600 | 0.015 | 0.025 | 0.003 | 0.020 | 0.010 | 0.015 | 0.015 | 0.043 | 0.010 | 0.005 | 0.010 | 0.003 | 0.003 |
| 35 | TR-2 | D | 48 | 1694 | 2 | 847 | 0.025 | 0.020 | 0.025 | 0.025 | 0.045 | 0.050 | 0.035 | 0.035 | 0.050 | 0.030 | 0.003 | 0.020 | 0.020 |
| 46 | TR-2 | K | 20 | 706 | 1 | 706 | 0.025 | 0.030 | 0.030 | 0.080 | 0.095 | 0.145 | 0.110 | 0.060 | 0.130 | 0.065 | 0.040 | 0.015 | 0.020 |
| 47 | TR-2 | D | 46 | 1624 | 2 | 812 | 0.050 | 0.040 | 0.060 | 0.050 | 0.050 | 0.040 | 0.025 | 0.050 | 0.030 | 0.020 | 0.020 | 0.020 | 0.020 |
| 48 | TR-2 | L | 40 | 1412 | 1 | 1412 | 0.030 | 0.025 | 0.030 | 0.050 | 0.025 | 0.045 | 0.003 | 0.020 | 0.050 | 0.010 | 0.003 | 0.003 | 0.003 |

### Appendix C. Air Concentrations of DDVP in Homes Where Pest Strips Were Installed. K = Kitchen, D = Dining Room, L = Living Room, and B = Bedroom.

| House No. | Room | Vol ($m^3$) | $ft^3$/strip | House No. | 1 | 7 | 14 | 21 | 29 | 35 | 42 | 49 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | K | 22.2 | 784 | 1 | 0.013 | 0.026 | 0.016 | 0.003 | 0.014 | 0.003 | 0.007 | 0.005 |
| 3 | K | 23 | 812 | 3 | 0.041 | 0.020 | 0.040 | 0.011 | 0.035 | 0.018 | 0.032 | 0.005 |
| 4 | D | 37.3 | 1317 | 4 | 0.028 | 0.012 | 0.021 | 0.018 | 0.024 | 0.003 | 0.015 | 0.005 |
| 7 | L | 27.6 | 974 | 7 | 0.016 | 0.013 | 0.014 | 0.011 | 0.021 | 0.020 | 0.018 | 0.028 |
| 12 | K | 25.4 | 897 | 12 | 0.018 | 0.032 | | 0.018 | 0.012 | 0.005 | 0.010 | 0.007 |
| 16 | D | 17.9 | 632 | 16 | 0.027 | 0.056 | 0.014 | 0.020 | 0.019 | 0.015 | 0.015 | 0.013 |
| 18 | L/D | 42 | 1483 | 18 | 0.005 | 0.023 | 0.008 | 0.003 | 0.003 | 0.005 | 0.007 | 0.005 |
| 20 | D | 24.8 | 875 | 20 | 0.019 | 0.060 | 0.011 | 0.022 | 0.015 | 0.003 | 0.021 | 0.009 |
| 22 | K | 23.8 | 840 | 22 | 0.058 | 0.032 | 0.032 | 0.013 | 0.040 | 0.024 | 0.024 | 0.052 |
| 27 | L | 35.2 | 1243 | 27 | 0.026 | 0.018 | 0.012 | 0.014 | 0.023 | 0.009 | 0.016 | 0.013 |

| House No. | Room | 56 | 63 | 70 | 77 | 84 | 91 | 98 | 105 | 112 | 119 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | K | 0.003 | 0.016 | 0.003 | 0.003 | 0.005 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 3 | K | 0.010 | 0.011 | 0.014 | 0.015 | 0.007 | 0.010 | 0.009 | 0.003 | 0.003 | 0.009 |
| 4 | D | 0.010 | 0.008 | 0.008 | 0.005 | 0.006 | 0.006 | 0.005 | 0.003 | 0.003 | 0.005 |
| 7 | L | 0.020 | 0.015 | 0.012 | 0.017 | 0.009 | 0.011 | 0.003 | 0.006 | 0.012 | 0.009 |
| 12 | K | 0.014 | 0.015 | 0.015 | | 0.003 | 0.005 | 0.008 | 0.007 | 0.005 | 0.003 |
| 16 | D | 0.005 | 0.012 | 0.003 | 0.003 | 0.003 | 0.007 | 0.006 | 0.003 | 0.003 | 0.014 |
| 18 | L/D | | 0.003 | 0.007 | 0.003 | 0.006 | 0.003 | 0.003 | 0.005 | 0.003 | 0.003 |
| 20 | D | 0.019 | 0.023 | 0.012 | 0.008 | 0.006 | 0.009 | 0.007 | 0.007 | 0.008 | 0.003 |
| 22 | K | 0.038 | 0.036 | 0.021 | 0.017 | 0.016 | 0.011 | 0.003 | 0.005 | 0.005 | 0.009 |
| 27 | L | 0.018 | 0.008 | 0.008 | 0.009 | 0.009 | 0.003 | 0.003 | 0.003 | 0.014 | |